DOCUMENT RESUME

ED 122 831 IR 003 449

AUTHOR Reiser, Robert A.; Gerlach, Vernon S.
TITLE Research on Simulation Games in Education; A Critical Analysis.
SPONS AGENCY Air Force Office of Scientific Research, Arlington, Va.
PUB DATE Apr 76
NOTE 19p.; Paper presented at the Annual Meeting of the American Educational Research Association (San Francisco, California, April 19-23, 1976)

EDRS PRICE MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS *Educational Games; Evaluation; Instructional Media; Knowledge Level; Learning Processes; *Literature Reviews; Research Methodology; *Simulation; Student Attitudes; Teaching Techniques

ABSTRACT

This paper summarizes and evaluates published research examining the use of simulation games in educational settings. Findings regarding the effects of simulation games on interest, attitudes, feeling of efficacy, knowledge, and intellectual skills are reviewed. Research shows that interest is usually aroused by the games themselves, but not necessarily by the subject matter the games represent. Findings concerning attitudes and feelings of efficacy have no apparent pattern, and student knowledge is not significantly affected by participation in a simulation game. The skill most likely to be affected by game participation is the ability to play the game. Research methods used to evaluate simulation games are reviewed and found to be less effective than they might be. Suggestions are offered for improving both simulation games and the research methods designed to evaluate them. (CH)

****
* Documents acquired by ERIC include many informal unpublished *
* materials not available from other sources. ERIC makes every effort *
* to obtain the best copy available. Nevertheless, items of marginal *
* reproducibility are often encountered and this affects the quality *
* of the microfiche and hardcopy reproductions ERIC makes available *
* via the ERIC Document Reproduction Service (EDRS). EDRS is not *
* responsible for the quality of the original document. Reproductions *
* supplied by EDRS are the best that can be made from the original. *
****

ED122831

RESEARCH ON SIMULATION GAMES IN EDUCATION

A CRITICAL ANALYSIS[1,2]

Robert A. Reiser, Florida State University

Vernon S. Gerlach, Arizona State University

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

Paper presented at the Annual Meeting of the

American Educational Research Association

San Francisco, California

April, 1976

IR003 449

[1]The authors wish to thank Ms. Maryann Barron for her assistance in preparing this paper.

[2]The research on which this paper was based was supported in part by the United States Air Force Office of Scientific Research Grant No. 75-2900, awarded to Arizona State University; Vernon S. Gerlach is the Principal Investigator.

Abstract

This paper summarizes and evaluates published research examining the use of simulation games in educational settings. The paper reviews findings regarding the effects of simulation games on (a) interest, (b) attitudes, (c) feeling of efficacy, (d) knowledge, and (e) intellectual skills. Research methods employed in the evaluation of simulation games are also reviewed. The review indicates that neither the research methods nor the simulation games are as good as they should and can be. Suggestions are offered for improving simulation games and the research methods designed to evaluate them.

Research on Simulation Games in Education - A Critical Analysis

Ten years ago the use of simulation games in schools was practically unheard of; today hundreds of teachers all over the country are employing simulation games in their classrooms. New simulation games are being developed at a very rapid pace to meet this demand. Unfortunately, research regarding the benefits of such games has not advanced nearly as rapidly (Boocock & Schild, 1968; Fletcher, 1971a; Greenlaw & Wyman, 1973). This report is an attempt to summarize and evaluate the results and the quality of the research that has been conducted.

Definitions of "game" are many and varied. Fletcher's (1971a) definition, which lists the following characteristics, is quite adequate in terms of the context of this paper:

(1) there is a set of players

(2) there is a set of rules telling what the players are permitted and forbidden to do during the game

(3) each player has a certain capacity to act (determined by the amount of resources and information given to him)

(4) there is a set of possible outcomes (goals) which are specified or determinable.

Simulation games are a subset of the set "games." In addition to having the characteristics described above, simulation games are an abstraction or representation of some aspect of the real world (Barton, 1970). . . Simulation games deal with such diverse topics as the generation gap, the ecological balance, the Civil War, the Cold War, consumer credit, and politics.

Research Results

Most of the simulation games research has examined the effects of games on one or more of the following variables: (a) interest, (b) attitudes, (c) feeling of efficacy, (d) knowledge, (e) intellectual skills. Findings regarding the effects of simulation games on each of these variables are discussed below.

Interest

It is frequently maintained that simulation games arouse student interest to a greater extent than do conventional teaching methods (Cherryholmes, 1966; Heitzmann, 1974; Livingston, Fennessey, Coleman, Edwards, & Kidder, 1973). The results of a number of studies do indicate high student interest in participating in simulation games (Chartier, 1972; Cohen, 1969; Cohen, 1970; Fletcher, 1971b; Lee & O'Leary, 1971). However, the results of many studies indicate that student interest in the subject matter represented in a simulation game is not increased by participation in the game (Boseman & Schellenberger, 1974; Livingston, 1970a; Livingston, 1970b; Livingston, 1971a). Edwards (1971b) is one of the few to have found that a simulation game increases student interest in the subject matter the game represents. Raia (1966) reached a similar conclusion, but the results of his study can also be interpeted as indicating that student interest was not affected (Boseman & Schellenberger, 1974). Based on the results of the studies discussed above, assertions that simulation games are effective interest-arousing devices should be qualified. Interest is usually aroused in the simulation games themselves, but not necessarily in the subject matter the games represent.

Attitudes

Many studies have been conducted to determine the effects of a simulation game on attitudes toward the subject matter represented in the game. Perhaps the most consistent finding is that students who play the simulation game Democracy will become more tolerant of political "log rolling," i.e., exchange of support by legislators (Livingston, 1971a, Livingston, 1972; Livingston & Kidder, 1972). However, Boocock (1968) found that participation in the Democracy game does not change attitudes toward legislators.

Studies examining the effects of participating in the simulation game Ghetto have not produced any conclusive results. The results of two studies (Kidder, 1971; Kidder & Aubertine, 1972) indicated that participation in the Ghetto game did not have an effect on student attitudes toward ghetto residents. However, other studies indicated that attitudes toward ghetto residents were improved by participation in the Ghetto game (Livingston, 1970a, Livingston, 1971b). One of the studies cited above (Livingston, 1971b) also was designed to determine whether attitude changes toward ghetto residents would persist over long periods of time. The results of the study indicated that after one week the Ghetto game did not have any effect on attitudes.

The conflicting results of the studies cited above are indicative of the general pattern of findings regarding the effects of simulation games on participants' attitudes. In some instances the results indicate simulation games affect attitudes, while in other instances the results indicate attitudes are not affected. The findings have no apparent pattern.

Feeling of Efficacy

The results of a 1966 survey of education in the United States (Campbell, Coleman, & Mood, 1966) indicated that an individual's success in school was strongly related to his feeling of efficacy - his belief in his ability to control his own destiny. Since the release of the survey many simulation researchers have conducted studies examining the effects of the Democracy game on participants' feelings of political efficacy. Results of these studies have varied considerably. In a study conducted by Livingston (1971a), students' feelings of political efficacy were significantly higher after they played the game than they were before they played the game. The results of a study by Boocock (1968) also indicated that participation in the Democracy game increased students' feelings of political efficacy. However, the results of three studies (Boocock, Schild, & Stoll, 1967; Livingston, 1971a; Livingston, 1972) indicated that participation in the Democracy game did not have an effect on feelings of political efficacy. Furthermore, the results of another study (Livingston & Kidder, 1972) indicated that the Democracy game had a slightly negative effect.

Two other studies, employing different games, have examined the effects of games on feelings of political efficacy. In one study (Vogel, 1973), students who had participated in the Metro Government game had significantly higher feelings of political efficacy than students who had received traditional instruction. However, in another study (Alley & Gladhart, 1975), participation in the Mayoral Election Game did not have a significant effect on students' feelings of political efficacy.

Researchers have also examined the effects of simulation game participation on feelings of efficacy in areas other than politics. Edwards (1971b) found that participation in a business game increased feelings of efficacy, while Boocock et al. (1967) found that feelings of efficacy were not affected by participation in a career decisions game. Just as in the area of political efficacy, these results are inconclusive. In general, the research findings do not enable us to state what effect simulation games will have on a participant's feeling of efficacy.

Knowledge

Knowledge has been defined as the recall of ideas or phenomenon (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956). Many studies have been designed to examine the effects of simulation games on student acquisition of knowledge. The studies often involve a comparison of the effects of simulation games and traditional instruction. The results of most of the studies of this type indicate that students acquire approximately the same amount of knowledge in a simulation game as they do in traditional instruction (Anderson, 1970; Boocock et al., 1967; Chartier, 1972; Fennessey, Livingston, Edwards, Kidder, & Nafziger, 1972). There have been only a few exceptions to this finding. The results of one portion of a study cited above (Boocock et al., 1967) indicated that students taught by traditional methods acquired more knowledge than students who had participated in a simulation game. Conversely, Baker (1968) found that students who participated in a simulation

game acquired significantly more knowledge than students who received traditional instruction. Fleccher (1970), however, has raised some serious questions about the validity of Baker's study.

Other than the findings reported by Baker, the findings regarding the effects of simulation games on the acquisition of knowledge have not been impressive. In a few instances (Boocock, 1968; Fletcher, 1971; Livingston, 1971c), student participation in a simulation game has had a positive effect, but in each case the magnitude of the effect has been rather small. In addition there have been other instances where student participation in a simulation game has not resulted in any increase in student acquisition of knowledge (Livingston, 1970a; Livingston, 1970b). These results indicate that, in general, student knowledge is not significantly affected by participation in a simulation game.

Intellectual Skills

According to Bloom et al. (1956), intellectual skills refer to an individual's ability to apply knowledge to new problems. Researchers studying the effects of simulation games have often examined students' ability to perform tasks of this type.

Many of the studies which have examined the effects of simulation games on intellectual skills have been in the field of business. McKenney (1962) found that student participation in a simulation game had a positive effect on ability to analyze a given business situation and make appropriate planning decisions. Raia (1966) obtained similar results. However, Boseman and Schellenberger (1974) found that simulation game participation did not have a significant effect on student ability to analyze a given business situation.

Similarly, Livingston (1971c) found that participation in a business simulation game did not have a significant effect on ability to evaluate given business decisions.

A number of other studies (Anderson, 1970; Chartier, 1972; Fennessey et al., 1972; Karweit & Livingston, 1969) indicate that simulation games do not have a significant effect on intellectual skills. Kidder and Guthrie (1971) did find that participation in a simulation game designed to teach behavior modification skills had a significant effect on the frequency with which students used positive reinforcement in a tutoring situation. However, they also found that participation in the game did not affect student ability to select behavior modification solutions to hypothetical problem situations.

A type of intellectual skill that was not examined in the studies cited above is a participant's performance in a simulation game. The results of a few studies indicated that performance in a simulation game can be improved by repeated participation in the game (Fletcher, 1971; Schild, 1968). Edwards (1971a), however, found that student performance in a simulation game does not improve after the second time the game is played.

The results of the studies examining the effects of simulation games on intellectual skills are ambiguous. It appears that participation in a simulation game can have a significant effect on intellectual skills, but this is not a frequent occurrence. The skill most likely to be affected by game participation is the ability to play the game.

Summary

The results of the research conducted with simulation games in education are, for the most part, not very positive. This is especially true with regard to the effects of simulation games in the cognitive domain. Results indicate

that simulation games rarely have a significant effect on the acquisition of knowledge, and usually do not have a significant effect on intellectual skills. The intellectual skill most likely to be affected by game participation is the ability to play the game. In the affective domain, there is no apparent pattern to the effects simulation games have on feelings of efficacy and attitudes toward the subject matter represented in a game. Studies also have indicated that students are interested in participating in simulation games, but that the simulation games do not necessarily arouse student interest in the subject matter the games represent. Taken as a whole, these results do not indicate that simulation games are a highly effective instructional device.

Research Methods

If, as the previous section of this paper indicates, the results of simulation games research are not very positive, then the fault lies, in part, with the research methods employed. One problem has been that simulation games researchers have had difficulty determining what dependent variables to examine (Fletcher, 1971a). Unfortunately, simulation games are rarely accompanied by materials which describe the objectives of the game (Boseman & Schellenberger, 1974). Even when objectives are stated, they are usually stated in non-behavioral terms. Thus, those who attempt to evaluate a game's effectiveness must infer what behaviors can be acquired by a student who plays the game. It seems likely that some researchers have measured behaviors a game could not teach and have failed to measure behaviors that were taught.

Simulation games should be designed to enable students to attain specific behavioral objectives and lists of those objectives should be included with the games. The specification of a simulation game's objectives would help researchers

determine what dependent variables they should examine. Furthermore, if the objectives were specified before a game was designed, the design procedure might be more systematic and might result in a more effective game.

In simulation games research, the effectiveness of a game is determined, of course, by measuring some dependent variables. However, dependent variables are not labelled uniformly in the research literature. In some instances different terms are used to describe the same behavior. For example, what has been called "intellectual learning" in one study (Boocock, 1968) has been called "attitude" in another study (Cohen, 1969). In other instances the same term has been used to describe different behaviors. For example, Edwards (1971b) discussed "motivation" in terms of student interest in a course and the amount of work students did in the course, whereas Cohen (1970) discussed "motivation" in terms of student interest in a game and student school attendance records. Terminology differences such as these are commonly found in the research literature and make it difficult to draw general conclusions from the research. In the future, simulation games researchers should define more precisely the dependent variables they examine, making certain that the definitions they use are consistent with definitions used in other studies.

Just as there are problems with the dependent variables examined in simulations research, there also are problems with the independent variables examined. Many of the simulation games studies involve comparisons between simulation games and other forms of instruction. Unfortunately, these studies do not contribute much to our understanding of what can, or does, make simulation games effective teaching devices. More studies should be designed to examine those variables which might contribute to the effectiveness of simulation games. The findings of studies of this type would help game designers develop more effective games.

One of the conditions necessary for experimentally determining the effectiveness of simulation games is that confounding factors are not present in the studies that are conducted. This brings us to another problem associated with simulation games research - the use of non-game activities before, during, and after a game. Orientation prior to a game, coaching during a game, and discussion after a game are often considered to be part of the game treatment (for example, see Livingston, 1971c; Kidder & Guthrie, 1971). However, these non-game activities may have effects which are independent of the effects of a game. Thus, in order to prevent a confounding of effects, non-game activities should not be included as part of a treatment, unless such an activity is being studied as an independent variable.

The problems discussed above, while not inclusive, represent some of the major problems associated with simulation games research. In summary, the authors suggest that in order to overcome these problems researchers should:

(1) examine as independent variables those factors which might contribute to the effectiveness of simulation games

(2) exclude non-game activities from the various treatments, unless such an activity is being examined as an independent variable

(3) identify some appropriate dependent variables to measure

(4) be consistent, across studies, in the terminology used to describe the studies.

Conclusion

As the first portion of this paper indicated, the use of simulation games has not been demonstrated to be a highly effective instructional method. Perhaps this is due to some of the problems with simulation games research methods. Or perhaps simulation games are not the highly effective instructional devices much of the early literature on simulation games proclaimed them to be. Or perhaps, as the authors of this paper believe, it is a bit of both - neither the research methods nor the simulation games are as good as they should and can be.

References

Alley, R. A., & Gladhart, S. C. Political efficacy of junior high youth: Effects of a mayoral election simulation. Simulation & Games, 1975, 6, 73-83.

Anderson, R. C. An experiment on behavioral learning in a consumer credit game. Simulation & Games, 1970, 1, 43-54.

Baker, E. H. A pre-Civil War simulation for teaching American history. In S. S. Boocock and E. O. Schild (Eds.), Simulation games in learning. Beverly Hills, Calif.: Sage, 1968.

Barton, R. F. A primer on simulation and gaming. Englewood Cliffs, N. J. : Prentice-Hall, 1970.

Bloom, B. S., Engelhart, M. D., Furst, E. J., Hill, W. H., & Krathwohl, D. R. Taxonomy of educational objectives: The classification of educational goals. Handbook I: Cognitive domain. New York: David McKay, 1956.

Boocock, S. S. An experimental study of the learning effects of two games with simulated environments. In S. S. Boocock and E. O. Schild (Eds.), Simulation games in learning. Beverly Hills, Calif.: Sage, 1968.

Boocock, S. S. and Schild, E. O. Introduction. In S. S. Boocock and E. O. Schild (Eds.), Simulation games in learning. Beverly Hills, Calif.: Sage, 1963.

Boocock, S. S., Schild, E. O., and Stoll, C. Simulation games and control beliefs (Report No. 10). Baltimore: Center for Social Organization of Schools, The Johns Hopkins University, 1967.

Boseman, F. G., & Schellenberger, R. E. Business gaming: An empirical appraisal. Simulation & Games, 1974, 5, 383-402.

Campbell, E., Coleman, J. S., & Mood, A. Equality of educational opportunity (Report to the U.S. Office of Education). Washington, D.C.: U.S. Government Printing Office, 1966.

Chartier, M. R. Learning effect: An experimental study of a simulation game and instrumented discussion. Simulation & Games, 1972, 3, 203-218.

Cherryholmes, C. H. Some current research on effectiveness of educational simulations: Implications for alternative strategies. American Behavioral Scientist, 1966, 2 (10), 4-7.

Cohen, K. C. The effects of two simulation games on the opinions and attitudes of selected sixth, seventh, and eighth grade students (Report No. 42). Baltimore: Center for Social Organization of Schools, The Johns Hopkins University, 1969.

Cohen, K. C. Effects of the 'Consumer Game' on learning and attitudes of selected seventh grade students in a target-area school (Report No. 65). Baltimore: Center for Social Organization of Schools, The Johns Hopkins University, 1970.

Edwards, K. J. The effects of ability, achievement, and number of plays on learning from a simulation game (Report No. 115). Baltimore: Center for Social Organization of Schools, The Johns Hopkins University, 1971. (a)

Edwards, K. J. Students' evaluation of a business simulation game as a learning experience (Report No. 121). Baltimore: Center for Social Organization of Schools, The Johns Hopkins University, 1971. (b)

Fennessey, G. M., Livingston, S. A., Edwards, K. J., Kidder, S. J., & Nafziger, A. W. Simulation, gaming, and conventional instruction: An experimental comparison (Report No. 128). Baltimore: Center for Social Organization of Schools, The Johns Hopkins University, 1972.

Fletcher, J. L. Review of Simulation games in learning edited by S. S. Boocock & E. O. Schild. Simulation & Games, 1970, 1, 211-220.

Fletcher, J. L. The effectiveness of simulation games as learning environments. Simulation & Games, 1971, 2, 425-454. (a)

Fletcher, J. L. Evaluation of learning in two social studies simulation games. Simulation & Games, 1971, 2, 259-286. (b)

Greenlaw, P. S., & Wyman, F. P. The teaching effectiveness of games in collegiate business courses. Simulation & Games, 1973, 4, 259-294.

Heitzmann, W. R. Educational games and simulations. Washington, D.C.: National Education Association, 1974.

Karweit, N. & Livingston, S. A. Group versus individual performance and learning in a computer game: An exploratory study (Report No. 51). Baltimore: Center for Social Organization of Schools, The Johns Hopkins University, 1969.

Kidder, S. J. Emotional arousal and attitude change during simulation games (Report No. 111). Baltimore: Center for Social Organization of Schools, The Johns Hopkins University, 1971.

Kidder, S. J., & Aubertine, H. E. Attitude change and number of plays of a social simulation game (Report No. 145). Baltimore: Center for Social Organization of Schools, The Johns Hopkins University, 1972.

Kidder, S. J., & Guthrie, J. T. The training effects of a behavior modification game (Report No. 116). Baltimore: Center for Social Organization of Schools, The Johns Hopkins University, 1971.

Lee, R. S., & O'Leary, A. Attitude and personality effects of a three-day simulation. Simulations & Games, 1971, 2, 309-347.

Livingston. S. A. Simulation games and attitude change: Attitudes toward the poor (Report No. 63). Baltimore: Center for Social Organization of Schools, The Johns Hopkins University, 1970. (a)

Livingston. S. A. Simulation games as advance organizers in the learning of social science materials: Experiments 1-3 (Report No. 64). Baltimore: Center for Social Organization of Schools, The Johns Hopkins University, 1970. (b)

Livingston, S. A. Effects of a legislative simulation game on the political attitudes of junior high school students (Report No. 114). Baltimore: Center for Social Organization of Schools, The Johns Hopkins University, 1971. (a)

Livingston, S. A. Simulation games and attitudes toward the poor: Three questionnaire studies (report No. 118). Baltimore: Center for Social Organization of Schools, The Johns Hopkins University, 1971. (b)

Livingston, S. A. Two types of learning in a business simulation (Report No. 104). Baltimore: Center for Social Organization of Schools, The Johns Hopkins University, 1971. (c)

Livingston, S. A. Simulation games and political attitudes: The importance of role identification and game structure (Report No. 140). Baltimore: Center for Social Organization of Schools, The Johns Hopkins University, 1972.

Livingston, S. A., Fennessey, G. M., Coleman, J. S., Edwards, K. J., and Kidder, S. J. The Hopkins games program: Final report on seven years of research (Report No. 155). Baltimore: Center for Social Organization of Schools, The Johns Hopkins University, 1973.

Livingston, S. A., and Kidder, S. J. Role identification and game structure: Effects on political attitudes (Report No. 134). Baltimore: Center for Social Organization of Schools, The Johns Hopkins University, 1972.

McKenney, J. L. An evaluation of a business game in an MBA curriculum. The journal of business, 1962, 35, 278-286.

Raia, A. P. A study of the educational value of management games. The journal of business, 1966, 39, 339-352.

Schild, E. O. The shaping of strategies. In S. S. Boocock and E. O. Schild (Eds.), Simulation games in learning. Beverly Hills, Calif.: Sage, 1968.

Vogel, R. The effects of a simulation game on the attitude of political efficacy. Simulation & Games, 1973, 4, 71-79.